PATENT SPECIFICATION 629,775

Application Date: Nov. 25, 1947. No. 31166/47.

Complete Specification Left: July. 28, 1948.

Complete Specification Accepted: Sept. 28, 1949.

Index at Acceptance :—**Classes 35**, A1a; **and 110(iii)**, B9a.

PROVISIONAL SPECIFICATION.

SPECIFICATION NO. 629,775

By a direction given under Section 17(1) of the Patents Act, 1949 this application proceeded in the name of Armstrong Siddeley Motors Limited, a British Company of Park Side, Coventry, Warwickshire.

THE PATENT OFFICE,
11th March, 1950.

DS 28609/1(13)/3340 150 3/50 R

the aircraft by means of its exhaust jet or which may drive one or more screw propellers.

Due to the high speed at which such a turbine plant operates (for example, fifteen thousand revolutions per minute), difficulty is encountered in supplying power for the various aircraft accessories—e.g., power for heating, lighting, and cooking, for "pressurizing" the cabin, for de-icing the wings, and controls, and possibly the air-screws if used and for the servo-mechanisms for the controls, undercarriage and the like. A common arrangement, at the present time, involves the use of a main electric generator disposed well remote from the power plant and driven from a step-up gearing which in turn is driven by a relatively-long shaft incorporating possibly two universal joints, the shaft being driven from an appropriate part of the power plant through a material step-down gearing. Not only are these parts relatively-heavy and cumbersome but there is a material loss of efficiency in such a drive. For example, the speed of the relatively-long shaft may be about 3,000 [illegible] thousand revolutions per minute and, in consequence, it can be of relatively-small size when giving an output of, say, eighty or a hundred horse-power, or more, such as may be required for all the aircraft accessories.

According to a further feature of the invention, the generator is disposed between the compressor of the plant and the turbine, or the turbine section which is nearest the compressor, being mounted radially within a combustion chamber unit extending between the compressor and the adjacent turbine section. In this case neither the radial or axial size of the power plant need be increased.

According to a further feature of the invention, the generator is a dynamo-electric machine of the kind adapted to serve also as a starting motor for the power plant.

Dated this 24th day of November, 1947.

WALFORD & HARDMAN BROWN,
Chartered Patent Agents,
Roslyn Chambers, 47, Warwick Road,
Coventry, Warwickshire.

COMPLETE SPECIFICATION.

Driving Aircraft Accessories.

We, ARMSTRONG SIDDELEY MOTORS LIMITED, a British Company, and WILLIAM HENRY LINDSEY, a British Subject, both of the Company's address, Park Side, Coventry, Warwickshire, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to an aircraft such

[*Price* 2/-]

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We, ARMSTRONG SIDDELEY MOTORS LIMITED, a British Company, and WILLIAM HENRY LINDSEY, a British Subject, both of the Company's address, Park Side, Coventry, Warwickshire, do hereby declare the nature of this invention to be as follows:—

This invention relates to an aircraft such as is powered by at least one internal-combustion turbine plant, which may propel the aircraft by means of its exhaust jet or which may drive one or more screw propellers.

Due to the high speed at which such a turbine plant operates (for example, fifteen thousand revolutions per minute), difficulty is encountered in supplying power for the various aircraft accessories—e.g., power for heating, lighting, and cooking, for "pressurizing" the cabin, for de-icing the wings, and controls, and possibly the air-screws if used, and for the servo-mechanisms for the controls, undercarriage and the like. A common arrangement, at the present time, involves the use of a main electric generator disposed well remote from the power plant and driven from a step-up gearing which in turn is driven by a relatively-long shaft incorporating possibly two universal joints, the shaft being driven from an appropriate part of the power plant through a material step-down gearing. Not only are these parts relatively-heavy and cumbersome but there is a material loss of efficiency in such a drive. For example, the speed of the relatively-long shaft may be about 3,000 revolutions per minute, and of the generator about 10,000.

The invention broadly consists in incorporating a high-speed electric generator in the power plant itself, the main shaft of the power plant, or one of the main shafts, serving as the rotor of the electric generator and being, of course, associated with a stator. In such a case the electric generator will operate at, say, a speed of fifteen thousand revolutions per minute and, in consequence, it can be of relatively-small size when giving an output of, say, eighty or a hundred horse-power, or more, such as may be required for all the aircraft accessories.

According to a further feature of the invention, the generator is disposed between the compressor of the plant and the turbine, or the turbine section which is nearest the compressor, being mounted radially within a combustion chamber unit extending between the compressor and the adjacent turbine section. In this case neither the radial or axial size of the power plant need be increased.

According to a further feature of the invention, the generator is a dynamo-electric machine of the kind adapted to serve also as a starting motor for the power plant.

Dated this 24th day of November, 1947.

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COMPLETE SPECIFICATION.

Driving Aircraft Accessories.

We, ARMSTRONG SIDDELEY MOTORS LIMITED, a British Company, and WILLIAM HENRY LINDSEY, a British Subject, both of the Company's address, Park Side, Coventry, Warwickshire, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to an aircraft such

[*Price* 2/-]

as is powered by at least one internal-combustion turbine plant, which may propel the aircraft by means of its exhaust jet or which may drive one or more screw propellers.

Due to the high speed at which such a turbine plant operates (for example, 15,000 revolutions per minute), difficulty is encountered in supplying electric power for the various aircraft accessories—e.g., power for heating, lighting, and cooking, for "pressurizing" the cabin, for de-icing the wings, and controls, and possibly the air-screws if used, and for electric servo mechanisms for the controls, undercarriage and the like. A common arrangement, at the present time, involves the use of a main electric generator disposed well remote from the power plant and driven from a step-up gearing which in turn is driven by a relatively-long shaft incorporating possibly two universal joints, the shaft being driven from an appropriate part of the power plant through a material step-down gearing. Not only are these parts relatively-heavy and cumbersome but there is a material loss of efficiency in such a drive. For example, the speed of the relatively-long shaft may be about 3,000 revolutions per minute, and of the generator about 10,000.

The invention broadly consists in incorporating a high-speed electric generator in the power plant itself, the main shaft of the power plant, or one of the main shafts, serving to carry the rotor of the electric generator, such rotor being, of course, associated with a surrounding stator. In such a case the electric generator will operate at, say, a speed of 15,000 revolutions per minute and, in consequence, it can be of relatively-small size even when giving an output of, say, sixty or seventy-five kilowatts or more, such as may be required for all the aircraft accessories; though in other cases, of course, a much smaller output will be all that will be required.

According to a further feature of the invention, the generator is disposed between the compressor of the plant and the nearest turbine section, being mounted radially within a combustion chamber unit extending between the compressor and the turbine section. In this case neither the radial or axial size of the power plant need be increased.

According to a further feature of the invention, the generator is a dynamo-electric machine of the kind adapted to serve also as a starting motor for the power plant.

In the accompanying diagrammatic drawings:—

Figure 1 is a fragmentary view, in part-sectional elevation, with two of the combustion chambers shown broken away, of an internal-combustion turbine plant, adapted according to the invention, for powering an aircraft;

Figure 2 is a fragmentary longitudinal section, to a larger scale, through one form of dynamo-electric machine, taken mainly on the line 2—2 of Figure 3, the machine being illustrated only in outli[redacted]and

Figure 3 is a cross-section thereof taken mainly on the line 3—3 of Figure 2.

Figure 1 indicates the outline of the output end 12 of an axial-flow compressor of the plant, the rotor of the compressor being driven by a shaft 13 from an axial-flow turbine section indicated in outline at 14. The compressor and nearest turbine section are axially spaced from one another. The combustion chamber unit in this case comprises six similar elongated combustion chambers 16, 16 arranged in a circle round the axis of the shaft 13. The combustion chambers receive compressed air from the outlet end of the compressor and, with fuel added in the chambers, deliver the products of combustion to the inlet of the turbine section 14, all in a manner well known in regard to an axial-flow internal-combustion turbine plant.

In the present instance a dynamo-electric machine 18, for generating electric power for supplying the various aircraft accessories, is mounted between the compressor 12 and the turbine section 14 within the interior of the combustion chamber unit, being driven directly by the shaft 13.

With reference now to Figures 2 and 3, these show the shaft 13 as having, between its ends, an enlarged portion 20 which may be fluted as shown for cooling purposes and upon which is mounted the winding-free (coil-less) rotor of the machine. This rotor consists of a plurality of similar annular laminations 21, 21 secured to the enlarged portion 20 against angular movement by means of a key 22, being endwise located on the enlarged portion in any conventional manner, as by means of end plates 23, 23 and retaining nuts 24, 24 (Figure 2). The rotor is shown by way of example as having twenty-four teeth 26, 26.

Surrounding and spaced radially from the shaft 13 is a stationary-casing 28 from the internal periphery of which the stator of the dynamo-electric machine is supported. The stator is shown as comprising four arcuate laminated portions 29, 29 each carrying an alternating current winding 30, 30 round it from which the generated voltage can be delivered by conductors (not shown) passing within the conduit 31 secured to the casing 28 and passing between two of the combustion chambers 16. Each of the arcuate portions 29 is gapped as shown at 32 (Figure 3), leaving two main pole pieces 33, 33 sub-divided into two poles, and each of these main pole pieces

33 carries a direct current winding 34, 34 round it to be energised from a battery (not shown) carried by the aircraft, the conductors thereof also being led along the conduit 31. A fixing means for the stator is indicated at 35 in Figure 2.

The particular dynamo-electric machine illustrated is adapted to generate, say, 10 kilowatts at 5,000 cycles and at 50 to 100 volts when the rotor is operating at 15,000 revolutions per minute. Obviously, however, larger outputs can be obtained as by increasing the axial length of the machine, or duplicating or triplicating it as desired.

For cooling the machine compressed air may be bled from the compressor and passed through the machine.

The machine is in a very favourable position in this respect, between the compressor and the turbine; and with such special cooling a relatively large output can be obtained from a relatively small machine.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. An aircraft such as is powered by at least one internal-combustion turbine plant, characterised in that a high-speed electric generator is incorporated in the power plant itself, the main shaft of the power plant, or one of the main shafts, serving to carry the rotor of the electric generator, such rotor being associated with surrounding stator.

2. An aircraft, according to Claim 1, and in which the power plant has the compressor spaced axially from the nearest turbine section, characterised in that the generator is disposed between the compressor and the turbine section, being mounted radially within a combustion chamber unit extending between the compressor and the turbine section.

3. An aircraft, according to Claim 1 or 2, characterised in that the generator is a dynamo-electric machine of the kind adapted to serve also as a starting motor for the power plant.

Dated this 27th day of July, 1948.

WALFORD & HARDMAN BROWN,
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Coventry, Warwickshire.

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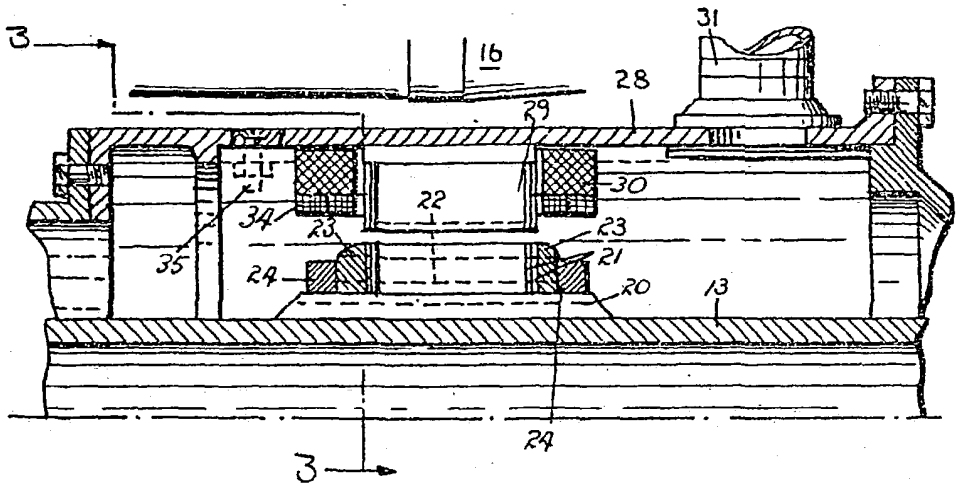


FIG. 2.

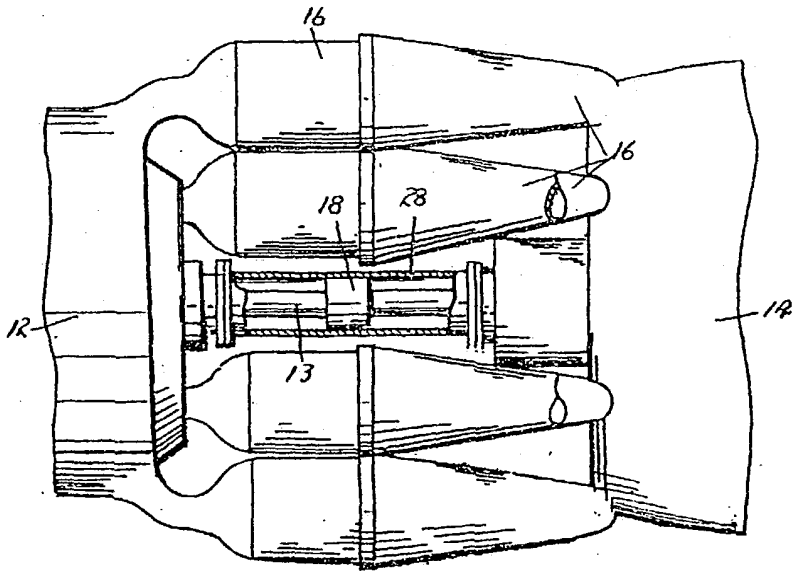
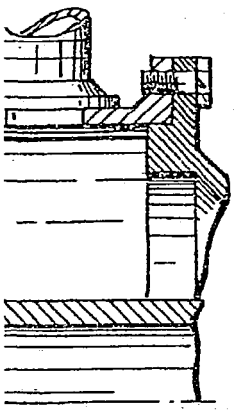
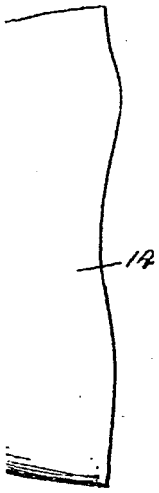


FIG. 1.





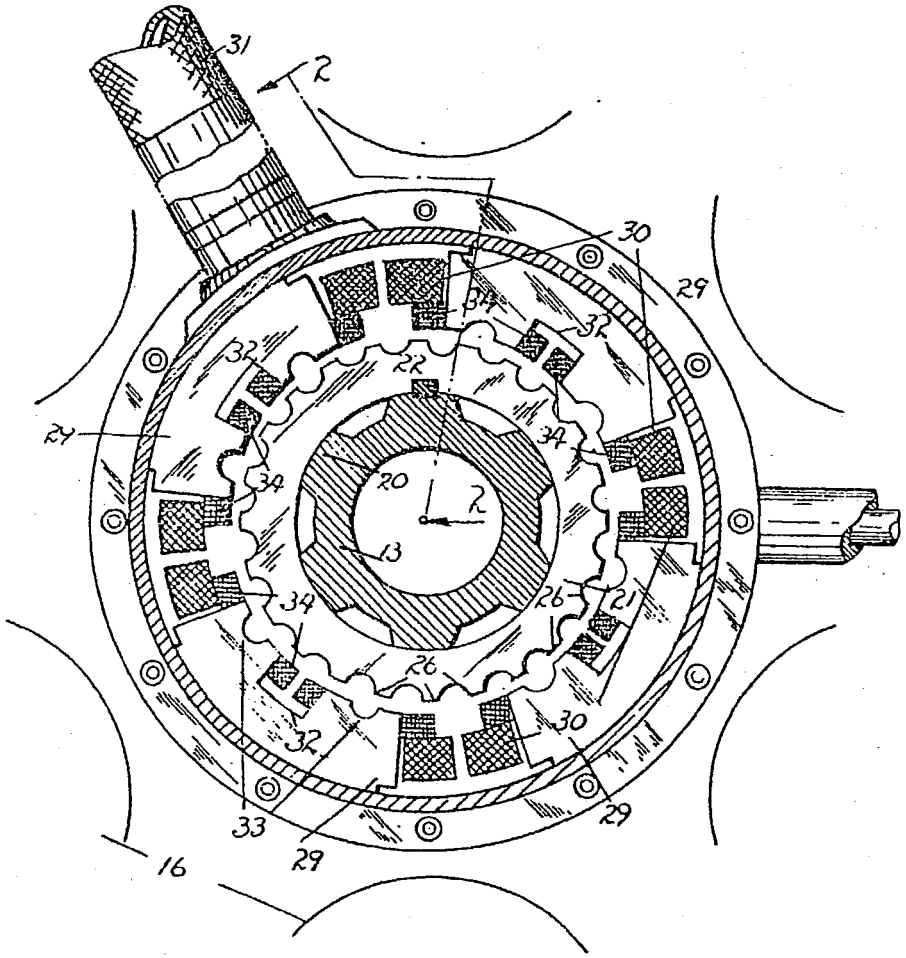


FIG. 3.

H.M.S.O. (Ty. P.)

629,775 COMPLETE SPECIFICATION

2 SHEETS

SHEET 1

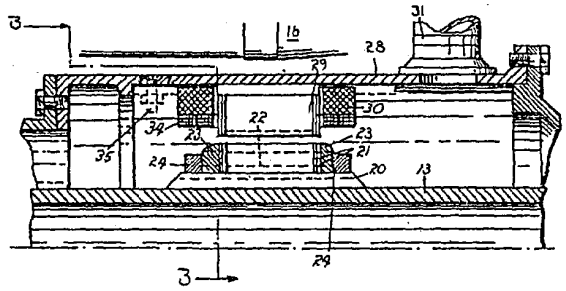


FIG. 2.

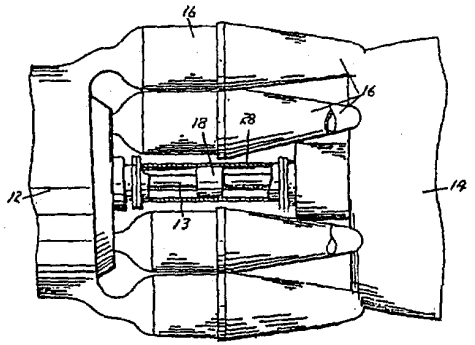


FIG. 1.

SHEET 2

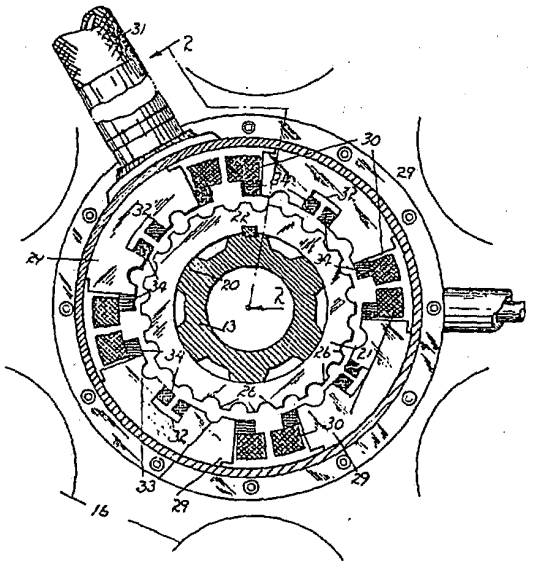


FIG. 3.

[This Drawing is a reproduction of the Original on a reduced scale.]

H.M.S.O.(Ty. P.)